

What is claimed is:

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5 comprising:

1. A digital telemetry system having improved data rate and robustness,

a data transmission cable having a first end and a second end, and
capable of transmitting data on at least two propagation modes;

10 a data source connected at the first end and having data transmission
circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end and having

a first receive circuitry to receive signals on a first of the at
least two propagation modes;

15 a second receive circuitry to receive signals on a second of the
at least two propagation modes;

an adaptive far-end cross-talk cancellation circuitry connected
to the first receive circuitry and to the second receive circuitry.

20 2. The digital telemetry system of Claim 1, wherein the adaptive far-end
cross-talk cancellation circuitry comprises:

25 a first propagation mode cross-talk adjustment circuit connected to
receive samples on a first propagation mode and having circuitry to accept
samples from a second propagation mode wherein the first propagation mode
cross-talk adjustment circuit adjusts the samples on the first propagation mode
by values that are a function of the samples of the second propagation mode.

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a slice residual determination logic connected to the output of the cross-talk adjustment circuit;

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$$CXYi = CXYi + AlphaFEXT * (< CEXi, CEXi > / REF_MAGN^2) * < TXFFT_out[i], TYresidual[i] >$$

where

CEXi is the frequency domain equalizer coefficient for the ith carrier of propagation mode X;

5 CXYi is the cross-talk cancellation coefficient for the ith carrier for
cancelling far-end cross-talk from propagation mode X to propagation mode
Y;

AlphaFEXT is a constant for balancing the tracking speed of CXY_i against the stability of the value of CXY_i ;

REF_MAGN is the RMS magnitude of the reference data points;

10 TXFFT_out[i] is the frequency domain data point on the ith carrier on
propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the Y propagation mode.

8. The digital telemetry system of Claim 2, wherein the far-end cross-talk
15 adjustment circuit receives m samples from the second receive circuitry and convolves
these using m coefficients.

9. The digital telemetry system of Claim 8, further comprising a slice determination logic and a coefficient update logic wherein the m coefficients are adjusted as a function of a slice residual determined by the slice determination logic.

10. The digital telemetry system of Claim 9, wherein the m coefficients are adjusted using the equation:

$$CXYi = CXYi + \text{AlphaFEXT} * (< CEXi, CEXi > / \text{REF_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} >$$

where,

CEXi is the *i*th time domain equalizer coefficient of propagation mode X;

5 CXYi is the *i*th cross-talk cancellation coefficient for canceling far-end cross-talk from propagation mode X onto propagation mode Y;

TYj is the *j*th sample from the second receive circuitry coefficient of propagation mode Y;

TXResidual is TXCorr- TXIdealPoint

10 where TXCorr is the cross-talk corrected output from the cross-talk adjustment circuit and TXIdealPoint is an ideal constellation point for propagation mode X; and

AlphaFEXT is a constant between 1 and 0.

15 11. The digital telemetry system of Claim 10, wherein AlphaFEXT is in the range 0.001 to 0.00001.

20 12. A method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first sample on a first propagation mode;

inputting a second sample on a second propagation mode;

25 determining a cross-talk component from the second sample; and

determining an output by subtracting the cross-talk component from the first sample.

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13. The method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode of Claim 12, further comprising:

determining the slice residual; and

5 adjusting a function used to determine the cross-talk component as a function of the slice residual.

14. The method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode of Claim 13, wherein the cross-talk component is determined by multiplying a carrier specific coefficient with a sample received on a corresponding carrier on the near-lying propagation mode.

15. The method digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode of Claim 14 wherein the coefficients are updated by applying the function:

$$CXYi = CXYi + \text{AlphaFEXT} * (< CEXi, CEXi > / \text{REF_MAGN}^2) * < \text{TXFFT_out}[i], \text{TYresidual}[i] >$$

where

20 CEXi is the frequency domain equalizer carrier for ith carrier of propagation mode X;

CXYi is the cross-talk cancellation coefficient for the ith carrier for canceling far-end cross-talk from propagation mode X to propagation mode Y;

25 AlphaFEXT is a constant for balancing the tracking speed of CXYi against the stability of the value of CXYi;

REF_MAGN is the RMS magnitude of the reference data points;

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$$AlphaFEXT * (< CEXi, CEXi > / REF_MAGN^2) * < TY_{(n-i)}, TXresidual >$$

where,

CEXi is the ith time domain equalizer coefficient for propagation mode X;

5 TYj is the j th sample from the second receive circuitry of propagation mode Y;

TXResidual is TXCorr - TXIdealPoint

where TXCorr is the cross-talk corrected output from the cross-talk
adjustment circuit and TXIdealPoint is an ideal constellation point for
10 propagation mode X; and

AlphaFEXT is a constant between 1 and 0.

20. The method of Claim 19 wherein AlphFEXT is in the range 0.001 to 0.0001.